



Biodiesel and Renewable Diesel Emissions Study and Biodiesel Multimedia Evaluation

Real-Time Particulate Matter Emissions

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 Mobile Source Control Division/
 Heavy Duty In-Use Strategies Branch

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INSTRUMENTS AND PARAMETERS MEASURED

1. **Differential Mobility Spectrometer (DMS 500, Cambustion Ltd)**
 - Size distribution and number concentration for C15 Caterpillar and MBE 4000 vehicles
 - Classifies particles (4.5 nm-1000nm) according to their electrical mobility
2. **Engine Exhaust Particle Sizer (EEPS 3090, TSI Inc)**
 - Size distribution and number concentration for 2006 Cummins ISM
 - Electrical mobility analyzer (6.04 nm-523nm)
3. **Electrical Aerosol Detector (EAD 3070A, TSI Inc)**
 - Particle length/diameter concentration (the total length of all the particles if placed in a line) for 2006 Cummins ISM and MBE 4000 vehicles
 - Diffusion Charger (10- ~1000nm)
4. **Photoelectric Aerosol Sensor (PAS 2000, Eco Chem)**
 - Particle bound polycyclic aromatic hydrocarbons (pPAH) for 2006 Cummins ISM and MBE 4000 vehicles
 - Photoionization of particle-bound PAH








Table 1 Number of driving runs used for data analysis

Fuel	2000 C15 Caterpillar		2006 Cummins ISM						2007 MBE 4000					
	Particle Number/ Size Dist.		Particle Number/ Size Dist.		Particle Length (PL, EAD)		pPAH (PAS)		Particle Number/ Size Dist.		Particle Length (PL, EAD)		pPAH (PAS)	
	Cruise	UDDS	Cruise	UDDS	Cruise	UDDS	Cruise	UDDS	Cruise	UDDS	Cruise	UDDS	Cruise	UDDS
CARB	2	2	6	6	6	6	6	6	6	12	6	12	6	12
Soy B20	NA	NA	3	3	3	3	3	2	3	8	3	8	3	8
Soy B50	1	1	3	3	3	3	3	3	3	9	3	8	2	8
Soy B100	1	1	3	3	3	3	3	3	3	7	3	9	3	9
AnB20	1	2	3	3	3	3	2	3	5	4(2)	4	4(2)	4	3(2)
An B50	1	NA	3	3	3	3	3	3	4	3	3	3	4	4(1)
An B100	1	1	3	3	3	3	3	3	4	4(1)	4(1)	4(1)	4	4(1)
R20	1	1	Renewable fuel was not tested for International and MBE 4000 trucks											
R50	1	NA												
R100	1	1												

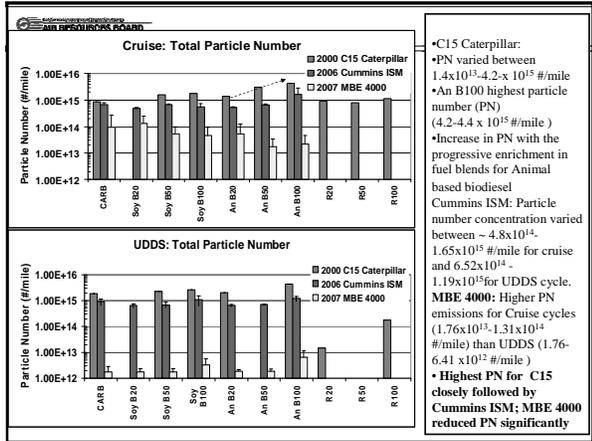
*A few single UDDS were run for MBE 4000 while testing Animal based biodiesel. These are denoted by the numbers in brackets (). Rest of the UDDSSs are composites of two single UDDSS.

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PARTICLE EMISSIONS IN TERMS OF NUMBER

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AIR RESOURCES BOARD

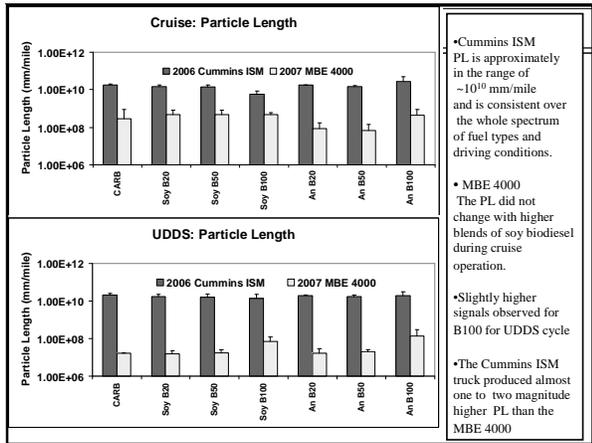
PARTICLE SIZE DISTRIBUTION

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**PARTICLE LENGTH (PL) / DIAMETER
CONCENTRATION**

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PARTICLE SURFACE BOUND PAH

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